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*XLI. An Account of the Magnetical Machine contrived by
the late Dr. Gowin Knight, F. R. S. and presented to
The Royal Society, by John Fothergill, M. D. F. R. S.*

TO THE PRESIDENT AND FELLOWS OF
THE ROYAL SOCIETY.

GENTLEMEN,

R. June 27, 1776. **B**Y being left executor to your late worthy member GOWEN KNIGHT, M. B. a very extraordinary magnetic machine of his contrivance, and which had cost him much labour and expence, came into my possession. This, I thought, might not be unworthy of a place in your repository; and I therefore desire your acceptance of it, as a monument of Dr. KNIGHT's very singular abilities, and of my regard to the purposes of your institution.

I must, however, inform you, that this machine, which, by the annexed figure and its explanation, may be observed to consist of two parts, is by no means so strongly magnetical as it was at the doctor's decease. Not long after this event, it was necessary to remove this apparatus from
his

his apartments in the British Museum. One of these parts was fixed up in your Museum, the other was left at the lodgings of one of your very useful, ingenious members, J. H. DE MAGELLAN, for the purpose of some experiments, and also for impregnating strongly the needles of sea-compasses. Here it was accidentally destroyed by fire, and the parts it consisted of rendered almost wholly useless. A new one has, however, been made, and impregnated with the magnetical power, by the ingenious gentleman abovementioned, according to the method of Dr. KNIGHT. It has acquired a considerable degree of magnetic force, by being placed in the polar line with the other part of this machine that was unhurt, and where in time it will, perhaps, acquire a considerable degree of magnetic energy.

I wish it had been in my power to have given a minute and pertinent detail of my deceased friend's discoveries in this branch of knowledge. He acquainted me, it is true, at different times in conversation, of the progress he had made in these discoveries; but, as I then thought he intended to leave behind him an exact account of his experiments and researches and their result, I rather listened to his relations as matters of instructive amusement, not thinking it would ever be necessary for any other person than himself to give the public an account of his labours. Indeed, there are many useful memorials of his, on this subject, in your own collections, to which I must refer the inquisitive reader. I shall only mention
some

some circumstances, relative to this machine, which I do not know have been related either by himself or any other person.

The first thing, I believe, that engaged the doctor's attention more particularly to magnetism, was the accident that befel a ship's compass from lightning; and of which, I think, the doctor gave a very circumstantial account to the society. This affair led him to consider the structure of the compass more minutely. He procured compass-cards ready-armed, as it is called, from different makers both at home and abroad. He found most of the needles strangely erring from due polarity; some being many points to the West, others as many to the East, of the right position. Amongst them all there was only one, which to him seemed constructed on a rational plan, and was of French make, procured from Marseilles; but even this was not without very evident faults.

To fix upon the proper form of a needle through which the magnetic effluvia could pass with the least interruption, to give the needle such a degree of hardness as to retain the magnetic influx the longest, and with the greatest force, were material objects; and, I imagine, a view to have such a degree of magnetic power at his command, as to force the magnetic virtue through the most consolidated bars, was his first inducement to try, whether he could not collect such a magazine of magnetism, as would be sufficient for every purpose of this kind, and at the same time exhibit some new phenomena in

physics yet undiscovered. With this view he planned and executed the machine, described at the end of this relation.

His first attempt, however, was much smaller; a few bars were laid in the due course of the magnetic flux, and impregnated by constant attrition. To these other bars were added successively, after they had been impregnated, both by the force he could give them by attrition, and what he could derive from the preceding stock collected in the bars. To these he added still fresh bars, till he had formed the whole mass as it is now presented to you, and resting on wheels and pivots, in such manner as to be easily manageable for the purpose of impregnating the needles he was employed to see prepared, for the service of government, and others, who had generosity enough to think, that the compass, on which depended the lives of the ship's crew, could not be made too perfect, and that it deserved a reasonable compensation. It is to the doctor's ingenuity and indefatigable attention to this useful instrument, that it has acquired amongst us a degree of perfection unknown to our predecessors.

When the machine was completed, he still was adding continually to its power. He impregnated every single bar of which it is composed, by repeated attritions, and applied it to the remaining bars in their magnetic position. After this operation, he always found its efficacy, for a season, considerably diminished; for the efflu-
via

via of each bar, though increased in virtue, seemed not immediately to have acquired a communication with each other. However, it grew always more powerful after each of these operations; and it is more than probable, if a person could be found, who, with equal patience and skill, would, at proper distances, repeat the same process, that the present machine would acquire a degree of force superior to what the original ever possessed, for much depends upon time and a due position. If to these was added a fresh impregnation of each single bar, by the means hitherto made use of, you would probably possess a larger fund of magnetic power, than exists in any artificial magnet now in being.

But if this cannot be obtained, if an able person cannot be prevailed upon to renew its vigour in this manner, it might possibly afford the curious some satisfaction, to know, whether, in its present state, it loses any force, or acquires fresh virtue; to know, with some degree of precision, how much weight it will now suspend; and to observe annually its variation. I need not suggest, that a trial of this nature demands no small attention. Even the motion of a carriage in the street, though at such a distance as the society's apartments, will make a considerable variation.

I do not know, that the doctor left behind him any description of a composition he had made to form artificial load-stones. I have seen in his possession, and many other of his friends have likewise seen, such a composition; which

retained the magnetic virtue in a manner much more fixed, than either any real load-stone or any magnetic bar, however well tempered. In the natural ones he could change the poles in an instant, so likewise in the hardest bars; but in the composition the poles were immoveable. He had several small pieces of this composition, which had strong magnetic powers. The largest was about half an inch in breadth, very little longer than broad, and near a quarter of an inch thick. It was not armed, but the ends were powerfully magnetic; nor could the poles be altered, though it was placed between two of his largest bars, and they were very strongly impregnated. The mass, was not very heavy, and had much the appearance of a piece of black lead, though not quite so shining. I believe he never divulged the composition; but, I think, he once told me, the basis of it was filings of iron, reduced by long-continued attrition with water to a perfectly impalpable state, and then incorporated with some pliant matter, to give it due consistence. Perhaps some of his acquaintance may have been more fully informed of this circumstance; and it may be rendering great aid to future enquirers, to know every thing that can be collected relative to so curious a subject.

Left the machine itself should again be exposed to a like accident with that which destroyed a part of it, I thought an exact representation of it, and its several parts, might be the best means of preserving it to future times, if inserted in the Transactions of the Royal Society.

Fig. 1.

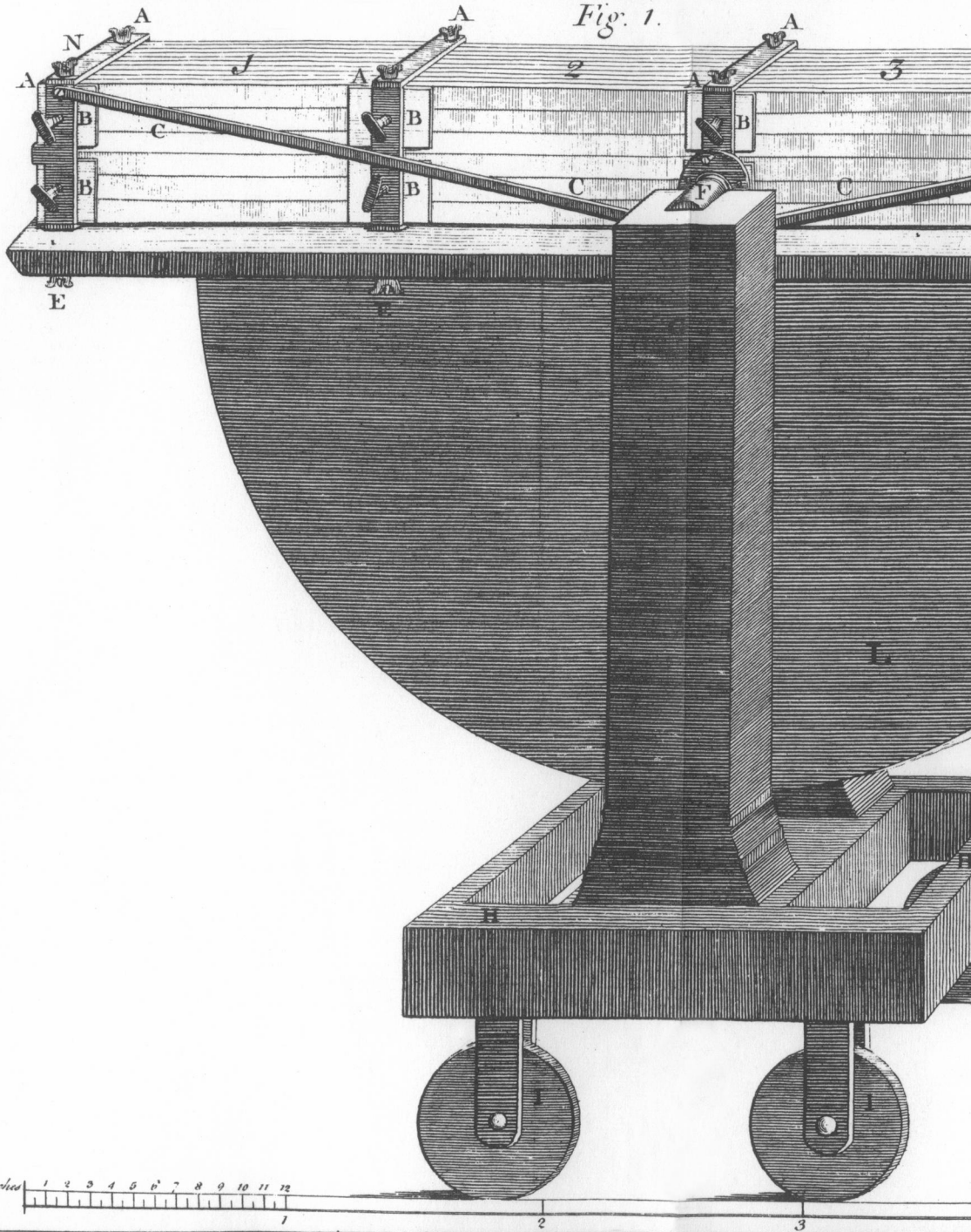


Fig. 1.

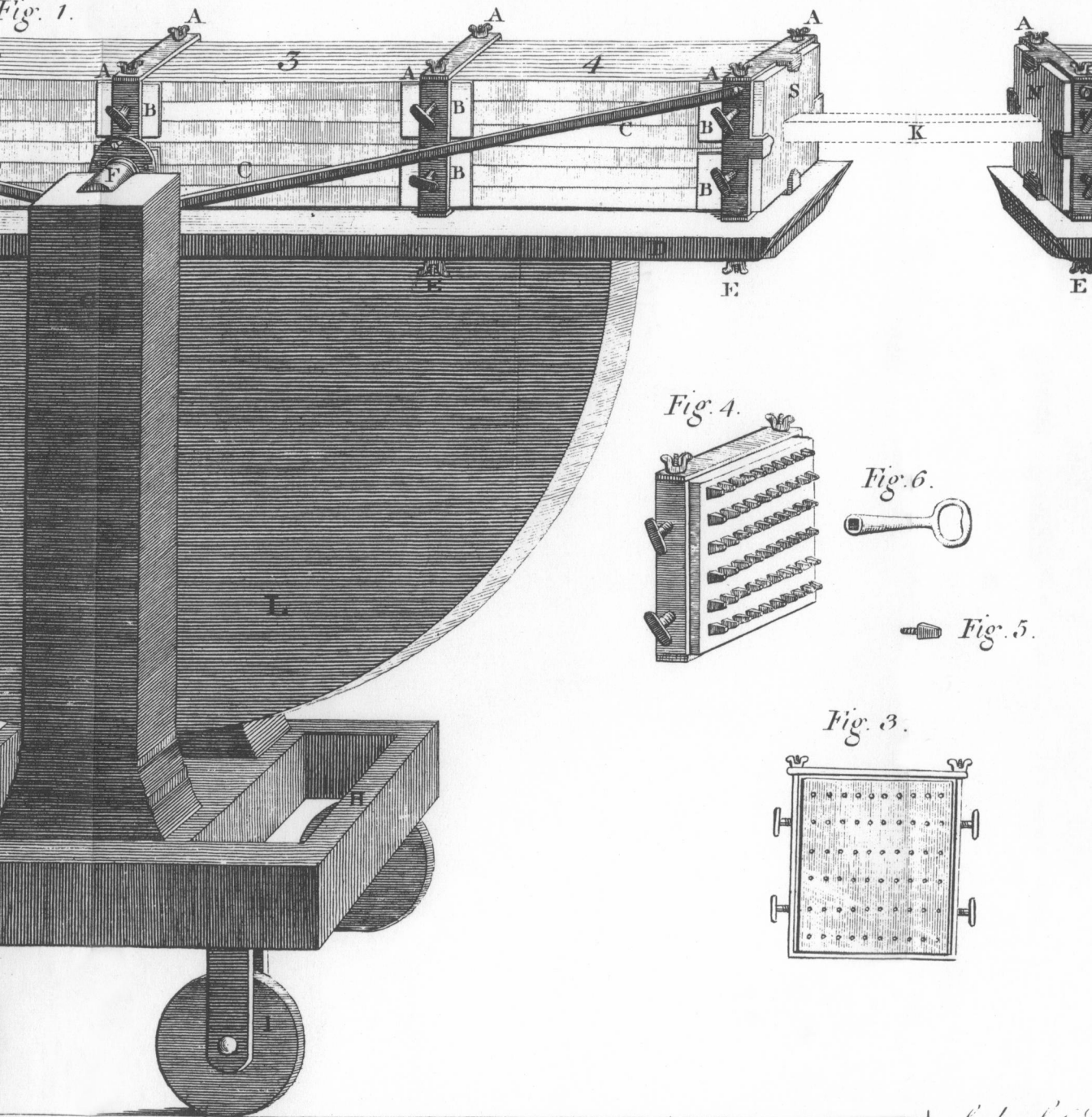


Fig. 4.

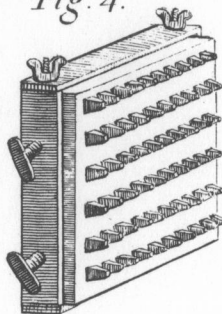


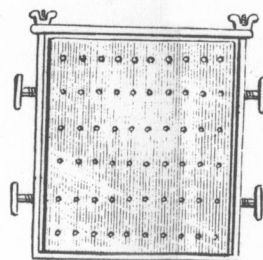
Fig. 6.



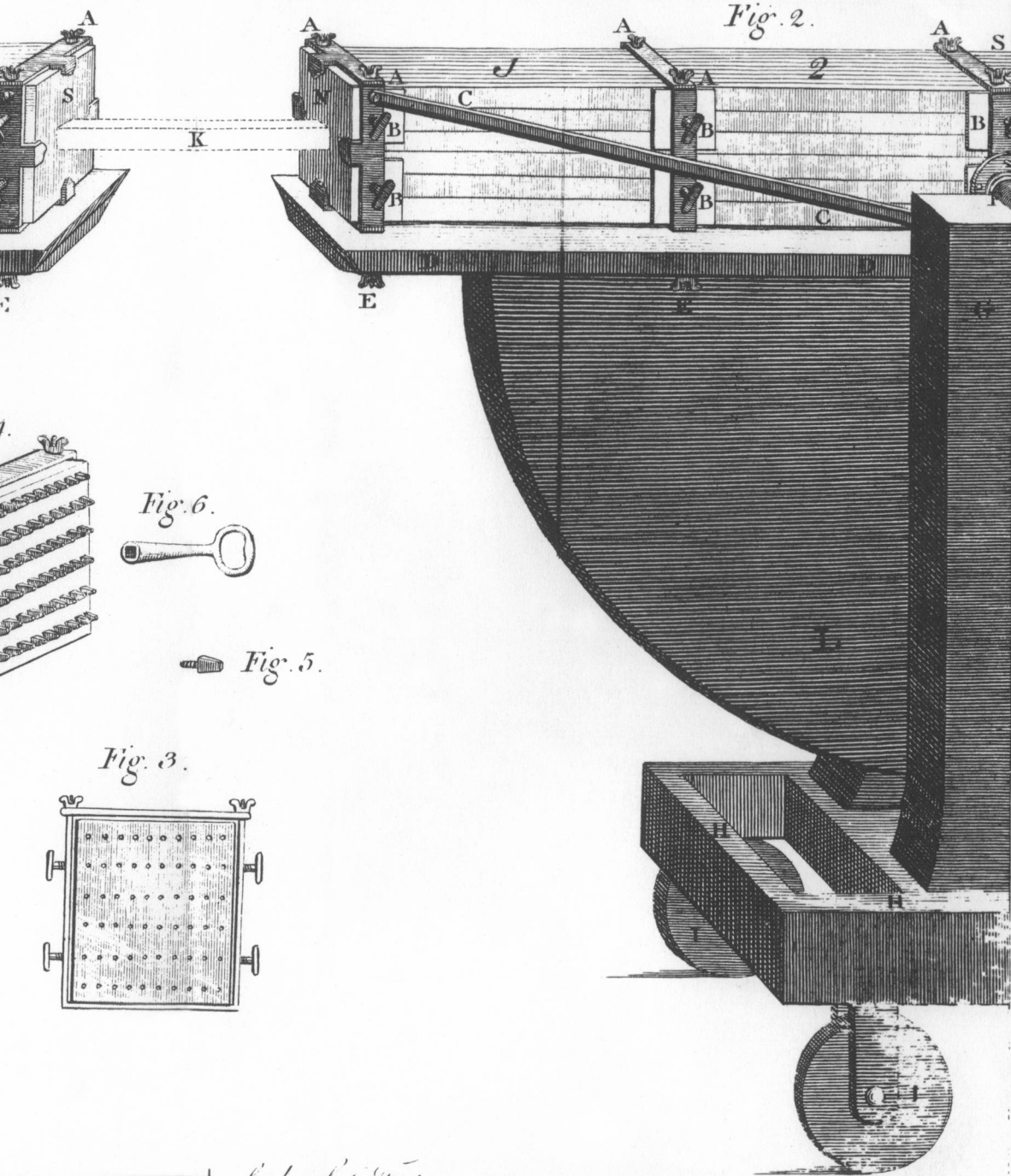
Fig. 5.



Fig. 3.



Scale of 68



EXPLANATION OF THE PLATE.

Plate VII. shews the magazines according to the doctor's last disposition of them. The two being perfectly alike, therefore fig. 2. contains only the half of one of them. Each magazine consists of 240 bars, disposed in four lengths, marked 1. 2. 3. 4.; every length containing sixty bars, placed in six courses or layers, in contact one on another; and ten in each course, placed side by side, in contact also. The bars being very nearly of a size, the ends of those in one length are in contact with the corresponding ends of those in the adjacent lengths. The magnetical North-ends of these bars, in each magazine, are all directed one way towards N; and the South-ends the contrary way toward S; thick plates of iron cover these ends N and S; the junction of the ends of the bars fall under the brass braces AA.

As it has been found difficult, after the final hardening of these bars, to preserve among them a perfect equality in size; therefore, the contact of their sides are perfected by thin iron plates BB, slipped in between the braces AA and the junction of the ends of the bars: and these plates BB, being pressed by the screws passing through the sides of the braces AA, keep the ends of the bars in as close contact as their figures will permit; and, that the bars may be kept end to end in contact, the iron plate at the North-end in fig. 1. and at the South-end in

fig. 2. is perforated with fixty holes, one againſt the end of each bar, as ſhewn at fig. 3. with a ſcrew fitted to each hole, as ſhewn at fig. 4.: every ſcrew having a ſquare head as at fig. 5. may, by help of the key fig. 6. be turned, and, by preſſing againſt the end of the bar in the fourth length, force it againſt its abutting bar in the third length, and ſo on till the bars, end to end, are brought into contact and kept ſo. The braces are in two pieces; the ſides and bottom in one; and the other piece forms the top AA, which is held cloſe to the bars by the ſcrews paſſing through it into the upright ſides of the braces; and, to keep the braces at N and S ſteadily in their places, the two long braces CC are affixed.

As each of theſe magazines weighed about 500 lbs. it became neceſſary to have them ſo placed as to be conveniently uſed. The doctor, therefore, by ſcrews fixed the braces, containing the bars, to a ſtrong mahogany plank DD, about $1\frac{3}{4}$ inches thick; the ſcrews paſſing through the plank entered the bottom parts of the braces AA. Againſt the middle of the whole length, two ſtrong braſs plates are well fixed to the ſides of the plank; to theſe braſs plates are fixed two cylindrical gudgeons F, which projecting from the ſides, like the trunnions of a cannon, lye in the ſockets of the ſtandard G, whereby the magazine eaſily turns, as on an axis; and is ſo well poized as to ſtand in any inclination of the line NS; and in this the equilibrium is aſſiſted by the ſtrong mahogany ſemi-circular pieces LL, fixed in a vertical poſition to

the middle of the under part of the plank DD, on which the magnetic apparatus rests. The standards G are fixed to the square frame HH, and the whole supported on the four trucks II, whereby the two magazines are easily brought end to end, or set at a convenient distance, so as to admit a bar K, to be placed between the ends, to be made magnetical.